

# IMPROVED MASKING METHODS AND ETCHING SEQUENCES FOR PATTERNING ELECTRODES OF HIGH DENSITY RAM CAPACITORS

## ABSTRACT OF THE DISCLOSURE

A method of etching a noble metal electrode layer disposed on a substrate to produce a semiconductor device including a plurality of electrodes separated by a distance equal to or less than about 0.35  $\mu\text{m}$  and having a noble metal profile equal to or greater than about 80°. The method comprises heating the substrate to a temperature greater than about 150°C, and etching the noble metal electrode layer by employing a high density inductively coupled plasma of an etchant gas comprising a gas selected from the group consisting of nitrogen, oxygen, a halogen (e.g., chlorine), argon, and a gas selected from the group consisting of  $\text{BCl}_3$ ,  $\text{HBr}$ , and  $\text{SiCl}_4$  mixtures thereof. A semiconductor device having a substrate and a plurality of noble metal electrodes supported by the substrate. The noble metal electrodes have a dimension (e.g., a width) which include a value equal to or less than about 0.3  $\mu\text{m}$  and a platinum profile equal to or greater than about 85°. Masking methods and etching sequences for patterning high density RAM capacitors are also provided. The substrate may be heated by a pedestal in a reactor chamber having a dielectric window including a deposit-receiving surface having a surface finish comprising a peak-to-valley roughness height with an average height value of greater than about 1,000Å.

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